

What is claimed is:

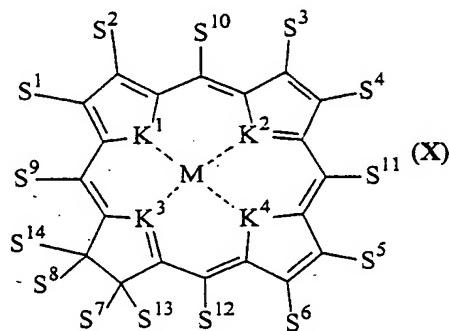
1. A method of making an oxochlorin, comprising the steps of:  
oxidizing a chlorin to produce a mixture of hydroxychlorin and oxochlorin;  
and then  
5 oxidizing said hydroxychlorin in said mixture with DDQ to produce a mixture  
consisting essentially of oxochlorin.
- 10 2. The method according to claim 1, wherein said step of oxidizing a chlorin is  
carried out by exposing said chlorin to alumina.
- 15 3. The method according to claim 1, wherein said step of oxidizing a chlorin is  
carried out in the presence of an oxidizing agent.
4. The method according to claim 3, wherein said oxidizing agent is oxygen or  
air.
- 18 5. The method according to claim 1, wherein said step of oxidizing a chlorin is  
carried out at a temperature of from 0 to 100 °C.
- 20 6. The method according to claim 1, wherein said step of oxidizing a chlorin is  
carried out in an aromatic organic solvent.
- 25 7. The method according to claim 1, wherein said step of oxidizing a chlorin is  
carried out in toluene.
8. The method according to claim 1, wherein said step of oxidizing said  
hydroxychlorin is carried out at a temperature of from 0 to 100 °C.
- 30 9. The method according to claim 1, wherein said step of oxidizing said  
hydroxychlorin is carried out in an aromatic organic solvent.
10. The method according to claim 1, wherein said step of oxidizing said  
hydroxychlorin is carried out in toluene.

11. The method according to claim 1, wherein said oxochlorin is a C-methylated chlorin.

5 12. The method according to claim 1, wherein said chlorin is metalated.

13. A method of making an oxochlorin, comprising the steps of:

(a) providing a chlorin of Formula X:



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wherein:

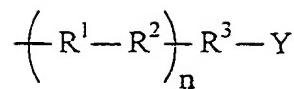
M is a metal selected from the group consisting of Zn, Mg, Pt, Pd, Sn and Al, or M is absent;

15 K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are hetero atoms independently selected from the group consisting of N, O, S, Se, Te, and CH;

S<sup>1</sup>, S<sup>2</sup>, S<sup>3</sup>, S<sup>4</sup>, S<sup>5</sup>, S<sup>6</sup>, S<sup>7</sup>, S<sup>8</sup>, S<sup>9</sup>, S<sup>10</sup>, S<sup>11</sup>, S<sup>12</sup>, S<sup>13</sup>, and S<sup>14</sup> are independently selected from the group consisting of H, aryl, phenyl, alkyl, cycloalkyl, spiroalkyl, alkenyl, alkynyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl;

20 and optionally either S<sup>1</sup> and S<sup>5</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, S<sup>2</sup> and S<sup>6</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, S<sup>10</sup> and S<sup>12</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, or S<sup>9</sup> and S<sup>11</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>; and

25 Q<sup>1</sup> and Q<sup>2</sup> are independently selected linking groups of the formula:



wherein:

n is from 0 or 1 to 5 or 10;

R<sup>3</sup> may be present or absent;

5 R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> are each independently selected from the group consisting of ethene, ethyne, aryl, and heteroaryl groups, which aryl and heteroaryl groups may be unsubstituted or substituted one or more times with H, aryl, phenyl; cycloalkyl, alkyl, alkenyl, alkynyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, 10 and carbamoyl;

Y is a protected or unprotected reactive substituent selected from the group consisting of hydroxy, thio, seleno, telluro, ester, carboxylic acid, boronic acid, phenol, silane, sulfonic acid, phosphonic acid, alkylthiol, formyl, halo, alkenyl, alkynyl, haloalkyl, dialkyl phosphonate, alkyl sulfonate, alkyl carboxylate, 15 acetylacetone, and dialkyl boronate groups;

(b) oxidizing said chlorin to produce a mixture of hydroxylchlorin and oxochlorin; and then

(c) oxidizing said hydroxylchlorin in said mixture with DDQ in toluene to produce a mixture consisting essentially of oxochlorin, said oxochlorin comprising a 20 compound of Formula X where S<sup>7</sup> and S<sup>13</sup> are together =O.

14. The method according to claim 13, wherein neither S<sup>8</sup> nor S<sup>14</sup> is H.

15. The method according to claim 13, wherein S<sup>9</sup> and S<sup>11</sup> are *trans*-25 substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>.

16. The method according to claim 13, wherein S<sup>10</sup> and S<sup>12</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>.

30 17. The method according to claim 13, wherein M is present.

18. The method according to claim 13, wherein M is Zn or Mg.

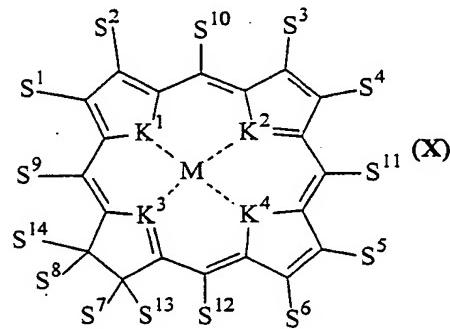
19. The method according to claim 13, wherein M is absent.

5        20. The method according to claim 13, wherein K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are independently selected from the group consisting of N, O, S, and CH.

21. The method according to claim 13, wherein K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are all N.

10        22. The method according to claim 13, wherein S<sup>4</sup>, S<sup>7</sup>, S<sup>8</sup>, S<sup>9</sup>, S<sup>10</sup>, S<sup>11</sup>, S<sup>12</sup>, S<sup>13</sup>, and S<sup>14</sup> are all alkyl.

23. A *trans* substituted oxochlorin compound of Formula X:



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wherein:

M is a metal selected from the group consisting of Zn, Mg, Pt, Pd, Sn and Al, or M is absent;

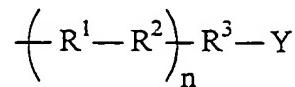
20        K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are hetero atoms independently selected from the group consisting of N, O, S, Se, Te, and CH;

S<sup>1</sup>, S<sup>2</sup>, S<sup>3</sup>, S<sup>4</sup>, S<sup>5</sup>, S<sup>6</sup>, S<sup>8</sup>, S<sup>9</sup>, S<sup>10</sup>, S<sup>11</sup>, S<sup>12</sup>, and S<sup>14</sup> are independently selected from the group consisting of H, aryl, phenyl, alkyl, cycloalkyl, spiroalkyl, alkenyl, alkynyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, and carbamoyl;

25        wherein S<sup>7</sup> and S<sup>13</sup> are together =O;

and either S<sup>1</sup> and S<sup>5</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, S<sup>2</sup> and S<sup>6</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, S<sup>10</sup> and S<sup>12</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>, or S<sup>9</sup> and S<sup>11</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>; and

5 Q<sup>1</sup> and Q<sup>2</sup> are independently selected linking groups of the formula:



wherein:

n is from 0 or 1 to 5 or 10;

R<sup>3</sup> may be present or absent;

10 R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> are each independently selected from the group consisting of ethene, ethyne, aryl, and heteroaryl groups, which aryl and heteroaryl groups may be unsubstituted or substituted one or more times with H, aryl, phenyl, cycloalkyl, alkyl, alkenyl, alkynyl, halogen, alkoxy, alkylthio, perfluoroalkyl, perfluoroaryl, pyridyl, cyano, thiocyanato, nitro, amino, alkylamino, acyl, sulfoxyl, sulfonyl, imido, amido, 15 and carbamoyl; and

Y is a protected or unprotected reactive substituent selected from the group consisting of hydroxy, thio, seleno, telluro, ester, carboxylic acid, boronic acid, phenol, silane, sulfonic acid, phosphonic acid, alkylthiol, formyl, halo, alkenyl, alkynyl, haloalkyl, dialkyl phosphonate, alkyl sulfonate, alkyl carboxylate, 20 acetylacetone, and dialkyl boronate groups.

24. The compound according to claim 23, wherein S<sup>9</sup> and S<sup>11</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>.

25 25. The compound according to claim 23, wherein S<sup>10</sup> and S<sup>12</sup> are *trans*-substituted linking groups Q<sup>1</sup> and Q<sup>2</sup>.

26. The compound according to claim 23, wherein neither S<sup>8</sup> nor S<sup>14</sup> is H.

30 27. The compound according to claim 23, wherein M is present.

28. The compound according to claim 23, wherein M is Zn or Mg.

29. The compound according to claim 23, wherein M is absent.

5        30. The compound according to claim 23, wherein K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are independently selected from the group consisting of N, O, S, and CH.

31. The compound according to claim 23, wherein K<sup>1</sup>, K<sup>2</sup>, K<sup>3</sup>, and K<sup>4</sup> are all N.

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32. The compound according to claim 23, wherein S<sup>4</sup>, S<sup>7</sup>, S<sup>8</sup>, S<sup>9</sup>, S<sup>10</sup>, S<sup>11</sup>, S<sup>12</sup>, S<sup>13</sup>, and S<sup>14</sup> are all alkyl.

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